

- NEWTON, I. 1979. Population ecology of raptors. Buteo Books. Vermillion, SD U.S.A.
- RABARISOA, R., R.T. WATSON, R. THORSTROM AND J. BERKLEMAN. 1997. Status of the Madagascar Fish-Eagle *Haliaeetus vociferoides* in 1995. *Ostrich* 68:8–12.
- WATSON, R.T. [ED.]. 1997. Madagascar wetlands conservation project. Progress Report III, 1995–1996. The Peregrine Fund, Boise, ID U.S.A.

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DUMPS FOR DEAD LIVESTOCK AND THE CONSERVATION OF WINTERING RED KITES (*MILVUS MILVUS*)

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The main European population of Red Kites (*Milvus milvus*) winters in Spain (Viñuela 1996), where management of this species is critical for its conservation. Red Kites usually feed on carrion (Cramp 1980) and refuse and carrion disposal sites may be important winter feeding areas (García et al. 1998). In this paper, I evaluate the importance of livestock carcass disposal sites for kites in the Ebro Valley, which, together with the northern plateau, is one of the most important wintering areas in Spain (De Juana et al. 1988, Sunyer and Viñuela 1996).

STUDY AREA AND METHODS

The study area was in the semiarid Mediterranean basin that is crossed by the Ebro River in northeastern Spain (Zaragoza and Huesca Provinces, 41°39'N, 00°54'W). Diet composition was studied by analysis of pellets collected in communal roosts that were used by most of the wintering population. This kind of analysis allowed me to infer indirectly the foraging habits of the birds, avoiding more costly techniques such as radiotracking.

I visited three of the most important roosts situated in the two main landscape types in this area: roosts Almuédvar and Leciñena were in dry lands (nonirrigated crops) and roost Luceni was in irrigated land near the Ebro River. In 1993, the number of Red Kites roosting at these three locations were 60, 75 and 90, respectively (SEO-Aragón 1994), remaining roughly constant during the study period. At the Almuédvar roost, pellets were collected at the end of February 1996 and reflected the winter diet. Leciñena and Luceni roosts were visited in November 1997 and reflected the autumn diet. Pellets were collected in the morning, when all the kites had left the roosts to avoid disturbance. Prey analyses were made according to Blanco et al. (1990), assuming that one kite consumed 95 g of food and regurgitated one pellet per

day. When the weight of one prey item in a pellet was heavier than this amount (e.g., a rabbit), we assumed that 95 g of prey had been consumed. When a pellet was composed of prey of lesser biomass, their partial contributions were added. When a pellet was composed of both prey over 95 g and prey of lesser biomass, we subtracted the weights of small prey from 95 g and added this amount to the heavier one. This method has been shown to accurately estimate diet composition in kites (Blanco et al. 1990). All prey weights were obtained from the literature. Prey were grouped in the following six categories: domestic animals (poultry, domestic rabbits and sheep), wild rabbits (*Oryctolagus cuniculus*) and hares (*Lepus granatensis*), small rodents, wild birds, reptiles and insects.

RESULTS

A total of 1892 food items were identified among the 262 pellets analyzed (Table 1). The most important food item in terms of biomass was carrion of domestic animals. Poultry and domestic rabbits made up >80% of the domestic-prey biomass, although other types of prey, such as small rodents and wild rabbits, were also important. Carrion of domestic animals and small rodents made up at least 60% of the biomass at the three roosts. On the Spanish northern plateau, carrion of small domestic animals has also been reported to be the main food of Red Kites but fluctuations in diet composition occur with cyclic fluctuations in numbers of common voles (*Microtus arvalis*) (Sunyer and Viñuela 1994, García et al. 1998). The high numerical importance of small rodents in my study could have also been related to the temporary abundance of voles (*Pitymys duodecimcostatus*), which made up 62% of the rodents consumed. High numbers of insects in the diet in autumn were probably associated with the massive emergence of flying ants which reached 85% of the total insect prey.

Table 1. Diet of the Red Kite at three roost sites in the mid-Ebro Valley, Spain.

	ROOST SITES					
	ALMUDÉVAR		LUCENI		LECIÑENA	
	%n ^a	%b ^b	%n	%b	%n	%b
Carrion	23.7	39.7	5.9	53.9	8.9	43.4
Wild lagomorphs	18.4	31.1	—	—	1.1	5
Rodents	38.2	20.4	12.1	32.3	21	42.1
Wild birds	7.2	8.7	1.4	7.2	1.2	4.3
Reptiles	—	—	—	—	0.1	0.6
Insects	12.5	0.1	80.6	6.6	67.7	4.6
Total prey items	152		861		879	
Total pellets	67		83		112	

^a Percent of prey items.

^b Percent of prey biomass.

Small livestock carcasses were mainly in dumps (Tella 1993). My data show the significance of these sites as food sources for Red Kites and concur with previous findings on the northern plateau (García et al. 1998). In other localities with fewer wintering kites, they mainly made use of alternative food sources such as game species and other wild animals (Blanco et al. 1990, Ortega and Casado 1991, García et al. 1998). Possibly, the use of predictable, localized carrion in dumps resulted in greater winter survival of kites (Donázar 1992) and the large number of wintering kites at carrion dumps. Owing to the fluctuations in vole numbers in Mediterranean areas of Europe, this human-related food source seems critical for some wintering populations of kites.

Some studies have shown the importance of maintaining traditional dumps for dead livestock (muladares) and refuse sites for the conservation of several species of threatened, scavenging raptors (Fernández 1990, Donázar 1992, Tella 1993, Donázar et al. 1996, Blanco 1997). Currently, sanitation regulations in Spain forbid leaving dead domestic animals in the field and management of dumps for dead livestock and refuse pits prevents raptors from exploiting them as feeding sites because carcasses are buried or dumped in ditches (Sampietro et al. 1997). These regulations are clearly discordant with the conservation of scavenger raptors whose populations are declining. Therefore, it is necessary to achieve better compatibility between health laws and wildlife preservation laws.

RESUMEN.—Se estudia la dieta otoñal e invernal del milano real (*Milvus milvus*) en el valle del Ebro (Aragón, NE España), una de las zonas más importantes para la invernada de la especie de toda Europa. Fueron analizadas 262 egagrópilas recogidas en tres de los dormideros más importantes del área de estudio sumando un total de 1892 presas. Carroña de pequeños animales domésticos (conejos y pollos de granja) y micromamíferos (arvicóli-

dos principalmente) totalizaron al menos el 60% de la biomasa en los tres dormideros. Otras presas importantes en frecuencia de captura fueron lagomorfos silvestres en invierno e insectos en la dieta otoñal. Dado que la mayor parte de los pequeños animales domésticos son vertidos en muladares en el área de estudio, se pone de manifiesto la importancia de estos puntos para la conservación europea de la especie, sobre todo teniendo en cuenta que las leyes zoonosanitarias en España son claramente incompatibles con la conservación de especies de aves rapaces carroñeras amenazadas.

[Traducción de Autor]

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LITERATURE CITED

- BLANCO, G. 1997. Role of refuse as food for migrant, floater and breeding Black Kites (*Milvus migrans*). *J Raptor Res.* 31:71–76.
- , F. HIRALDO AND B. HEREDIA. 1990. Variations in the diet and foraging behavior of a wintering Red Kite (*Milvus milvus*) population in response to changes in food availability. *Ardeola* 37:267–278.
- CRAMP, S. 1980. The birds of the western Palearctic. Vol 2. Academic Press, London, U.K.
- DE JUANA, E., F. DE JUANA AND S. CALVO. 1988. La invernada de las aves de presa (O. Falconiformes) en la Península Ibérica. Pages 97–122 in J.L. Tellería [ED.], Invernada de aves en la Península Ibérica. Monografía No. 1., SEO-BirdLife, Madrid, Spain.
- DONÁZAR, J.A. 1992. Muladares y basureros en la biología y conservación de las aves en España. *Ardeola* 39:29–40.
- , O. CEBALLOS AND J.L. TELLA. 1996. Communal roosts of Egyptian Vultures (*Neophron percnopterus*): dynamics and implications for the species conservation. Pages 189–201 in J. Muntaner and J. Mayol [EDS], Biology and conservation of Mediterranean raptors, 1994. Monografía No. 4. SEO-BirdLife, Madrid, Spain.
- FERNÁNDEZ, C. 1990. Importancia de los muladares en la alimentación de los buitres. *Quercus* 50:11–17.
- GARCÍA, J.T., J. VIÑUELA AND C. SUNYER. 1998. Geographic variation of the winter diet of the Red Kite *Milvus milvus* in the Iberian Peninsula. *Ibis* 140:302–309.
- ORTEGA, A. AND S. CASADO. 1991. Alimentación del milano real *Milvus milvus* en la provincia de Madrid. *Doñana Acta Vertebrata* 18:195–204.
- SAMPIETRO, F.J., E. PELAYO AND M. CABRERA. 1997. La importancia de los muladares en la conservación de las rapaces carroñeras en Aragón. *Quercus* 137:18–22.
- SEO-ARAGÓN. 1994. Anuario ornitológico de Aragón. Zaragoza, Spain.
- SUNYER, C. AND J. VIÑUELA. 1994. Variación temporal en

los hábitos alimentarios del milano real durante la invernada en la Meseta Norte. *Ardeola* 41:161–167.

- AND ———. 1996. Invernada de rapaces (O. Falconiformes) en España peninsular e Islas Baleares. Pages 361–370 in J. Muntaner and J. Mayol [EDS.], *Biology and conservation of Mediterranean raptors*, 1994. Monografía No. 4. SEO-BirdLife, Madrid, Spain.
- TELLA, J.L. 1993. Inventariado de los muladares y la valoración de su importancia para el Alimoche (*Ne-*

phron percnopterus) en el valle Medio del Ebro. Servicio Provincial de Agricultura, Ganadería y Montes. Diputación General de Aragón, Zaragoza, Spain.

- VIÑUELA, J. 1996. Situación del milano real (*Milvus milvus*) en el Mediterráneo. Pages 91–100 in J. Muntaner and J. Mayol [EDS.], *Biology and conservation of Mediterranean raptors*, 1994. Monografía No. 4. SEO-BirdLife, Madrid, Spain.

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